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NOTES ON THE OSTEOLOGY OF THE SKULL OF PARIOTICHUS

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In the summer of 1910 Dr. S. W. Williston asked the writer to study the Pariotichus skulls in Walker Geological Museum of the University of Chicago to see if they would throw any light on some of the undecided points concerning the osteology of that genus. The material was fragmentary with the exception of one remarkable specimen of *Pariotichus laticeps* Williston, a skull of *Pariotichus aguti* Cope ?, and the base of a skull of an unidentified species. Some of the undecided questions were: Are squamosal and prosquamosal both present? Is there a distinct quadratojugal? What are the homologies of the tabulare, if such a bone is present? What are the homologies of the so-called epiotics, quadratojugals of Case? Is a presphenoid present? and What is the arrangement of the bones in the base of the skull?

The writer's thanks are due Dr. Williston for the use of the specimens and for discussions during the investigation.

In a paper published in 1878[1] Cope gave the name *Pariotichus brachyops* to an imperfect skull from the Permian of Texas, and later in the same paper described a more perfect skull as *Ectocynodon ordinatus*. As he supposed that the former had the roof of the skull unsculptured he referred the specimens to different genera. In 1882 he described *Ectocynodon aguti*[2] and in 1888 *Ectocynodon incisivus*.[3] In 1896 he referred all of the Ectocynodonts to Pariotichus and named two more species, *P. aduncus*[4] and *P. isolomus*.[5] In the paper where he named the latter he described

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[1] *Proc. Am. Philos. Soc.*, XVII, 508.

[2] *Ibid.*, XX, 290.

[3] *Trans. Am. Philos. Soc.*, XVI, 290.

[4] *Proc. Am. Philos. Soc.*, XXXV, 135.

[5] *Ibid.*, XXXIV, 145.

Captorhinus angusticeps, which has recently been referred to Pariotichus by Broom.[1] In 1909 Williston described and figured *Pariotichus laticeps*.[2]

Roof of skull.—No separation of the squamosal into two bones was observed in either Pariotichus or the closely related genus Labidosaurus. Williston first called attention to this in Labidosaurus[3] and Broom shows no separation in his figures of Pariotichus.[4]

A quadratojugal is present in its normal position in the temporal region and this bone is also present in Labidosaurus. Its distinctness is not apparent in the type specimen of *Pariotichus laticeps* Williston, and was first noted in a specimen of Labidosaurus recently acquired by Walker Geological Museum, and corroborated by examination of other specimens. Dr. Case calls an element in the base of the skull the quadratojugal, but it seems to be a part of the squamosal. This part of the squamosal is indicated by the numeral "2" in Fig. 3. In a specimen of Labidosaurus figured by Williston, this part of the bone seems to be separate, but in all other specimens examined there is no evidence of separation. Dr. Williston worked over all of the skulls of Pariotichus and Labidosaurus in the Walker Geological Museum to see if we agreed on this point and we are now in accord in saying that this is probably not a separate element.

In 1883 in describing *Pariotichus megalops*, since referred to Isodectes, Cope said: "At the extreme posterior angle is a very small element in contact with the supraoccipital which may be the true intercalare."[5] In 1896 he figured this bone in *Pariotichus aguti* Cope,[6] and Case[7] and Broom[8] figure it in *Pariotichus angusticeps* Cope. It is present in the form figured in this paper; and in one or two other specimens of Pariotichus examined by the writer it is distinctly separated from the parietal, but there is no indication of it in Labidosaurus. Cope also applied the name tabulare to the element and recently Broom has suggested the name post-temporal. There seems to be no valid objection to tabulare and it has the advantage of priority over Broom's name.

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[1] *Bull. Am. Mus. Nat. Hist.*, XXVIII, 218.

[2] *Biol. Bull.*, XVII, 241–55.

[3] *Am. Jour. Anat.*, X (1910), 74.

[4] *Bull. Am. Mus. Nat. Hist.*, XXVIII, 218.

[5] *Proc. Am. Philos. Soc.*, XX, 630.

[6] *Am. Naturalist*, XXX, Pl. VII.

[7] *Bull. Am. Mus. Nat. Hist.*, XXVIII, 194.

[8] *Ibid.*, XXVIII, 218.

All writers seem to be agreed about the rest of the bones in the roof of the shull.

Base of skull.—The bases of several skulls examined during the investigation were fairly well preserved and the one from which Fig. 3 was made is almost perfect. This shows the post-parietals in the same position as figured by Williston in Labidosaurus[1] and by Case in Edaphosaurus[2] and Pariotichus. (Case calls them epiotics in Edaphosaurus.)

The exoccipitals are large and articulate with the squamosals after passing in front of the inturned edge of the latter, the quadratojugals of Case. The stapes, tympanic of Broom, articulates at its distal end with the lower inner end of the quadrate. In the drawing it is not shown distinctly separated from the exoccipital, the sutures not having been determined. The separation in this form is probably as shown by Williston in Labidosaurus.

The position of the quadrate is almost vertical with a broad bladelike process above and a heavy expanded portion below. The bladelike portion projects forward almost parallel with the median line of the skull, and the posterior end of the pterygoid rests against it. Its upper end comes in contact with the squamosal and the outer side of the base touches the quadratojugal.

Floor of skull.—The pterygoids extend from near the posterior end of the skull almost to the anterior end. They meet in the median line and are not separated by the basisphenoid as shown by Broom in *Pariotichus angusticeps* Cope.[3] The sutures between the long slender palatines and the pterygoids were made out in one specimen from the anterior end to near the posterior end, as shown by solid lines in the drawing. There are strong indications of a transverse as shown by broken lines in Fig. 4, but the evidence is not entirely convincing. The presphenoid is perfectly preserved in one specimen in Walker Geological Museum but is lost in all others examined. It is slender and extends about half the distance from the basisphenoid to the anterior end of the skull. The sutures between the vomers and palatines are not evident in any of the specimens studied.

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[1] *Amer. Jour. Anat.*, X, Pl. III, Fig. 4.

[2] *Revision of the Pelycosauria of North America*, 1907, p. 153.

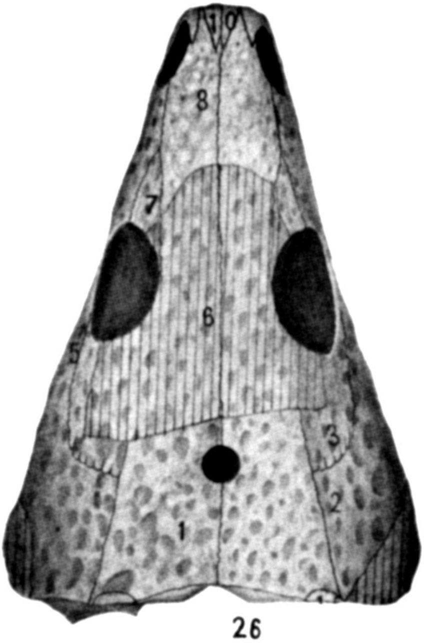
[3] *Bull. Am. Mus. Nat. Hist.*, XXVIII (1910), 218.

In the specimen shown in Figs. 1 and 2, which is probably *Pariotichus aguti* Cope, though it has only two teeth on the premaxillaries, the teeth on the maxillae are in one row to behind the fifth where a second row begins inside the first, and behind this two other rather indistinctly defined rows appear. Nearly all of the teeth are subcircular in cross-section near the base, but some of the posterior ones are more or less compressed laterally.

The distinction between Pariotichus and Labidosaurus made by Cope, that the latter had the teeth of the maxillae in one row, breaks down in the Walker Geological Museum specimens. In two specimens examined during the present investigation a second row of teeth is evident and in other specimens the preservation is not such as to show whether there is more than one row.

Mandible.—The dentary makes up the outer part of the anterior half of the mandible. Just behind the dentary there is a short coronoid which occupies about one-third of the width of the jaw and sends upward a very large coronoid process almost equal in width to the rest of the mandible. Behind the coronoid the angular makes up most of the outer part of the posterior half of the jaw, and also sends forward a slender process between the dentary and the splenial, which reaches almost to the tip of the mandible. Above the angular and separated from it by a suture that runs diagonally across the jaw and passes to the posterior inferior corner, there seems to be a surangular. The splenial is not well preserved in any specimen observed and all that can be determined is that it is a broad flat bone on the inside of the jaw. The articular is imperfect in all of the specimens, but in a perfect specimen of a closely allied form, found completely separated from the other bones of the jaw, it is heavy at the posterior end and sends a long slender process forward.

PLATE I



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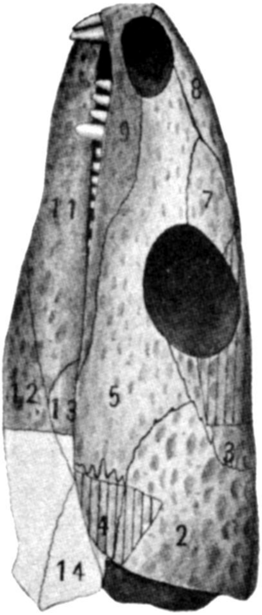

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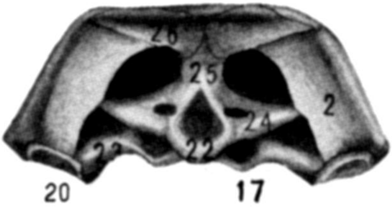

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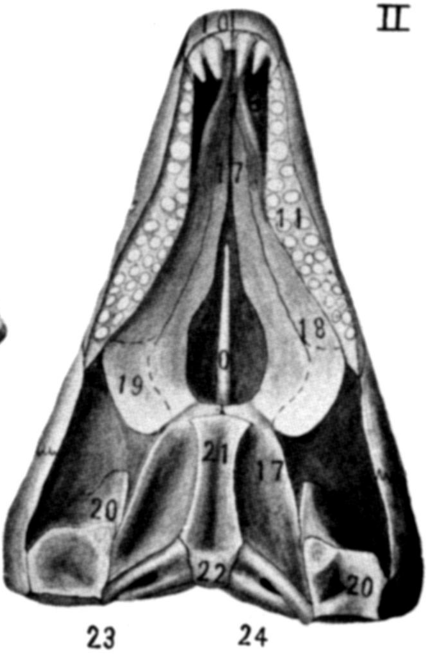

IV

EXPLANATION OF PLATE

(The figures on this plate are natural size)

FIG. 1.—Top view of skull of *Pariotichus aguti* Cope.

FIG. 2.—Lateral view of skull of *Pariotichus aguti* Cope.

FIG. 3.—Base of skull of Pariotichus, species unidentified.

FIG. 4.—Floor of skull of Pariotichus restored from three specimens.

1, parietal; 2, squamosal; 3, postorbital; 4, quadratojugal; 5, jugal; 6, frontal; 7, prefrontal; 8, nasal; 9, maxilla; 10, premaxillae; 11, dentary; 12, angular; 13, coronoid; 14, surangular; 15, tabulare; 16, vomer; 17, pterygoids; 18, palatines; 19, transverse; 20, quadrate; 21, basisphenoid; 22, basioccipital; 23, stapes; 24, exoccipital; 25, supraoccipital; 26, postparietal. (As the surface sculpture was not well preserved in any of the specimens no attempt was made to reproduce it exactly in the drawings.) Lined areas are restored.